Extreme Networks®
Pluggable Interface Modules
Installation Guide

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For safety compliance information, see Appendix A.

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Preface

This guide provides information about installing pluggable interface modules in the following Extreme Networks® switches:

- BlackDiamond® 8800 series switches
- BlackDiamond 10808 switch
- BlackDiamond 12800 series switches
- BlackDiamond 20800 series switches
- Summit® family switches:
  - Summit X150 series switches
  - Summit X250e series switches
  - Summit X350 series switches
  - Summit X450 series switches
  - Summit X450a series switches
  - Summit X450e series switches
  - Summit X460 series switches
  - Summit X480 series switches
  - Summit x650 series switches
  - Summit X670 series switches

NOTE

The term *Summit family switches* is used to refer to the group of all the different Summit switch series.

The types of pluggable interface modules used in Extreme Networks switches include small form factor pluggable (SFP, SFP+, and QSFP+) modules, XFP transceivers, and XENPAK modules.

This guide is intended for use by network administrators responsible for installing and setting up network equipment. It assumes a basic working knowledge of:

- Local area networks (LANs)
- Ethernet concepts
- Ethernet switching and bridging concepts
- Routing concepts
- Simple Network Management Protocol (SNMP)
- Basic equipment installation procedures

See the *ExtremeXOS Concepts Guide* and the *ExtremeXOS Command Reference Guide* for information about installing and configuring the Extreme Networks switches mentioned in this guide.

See the hardware installation guides listed under "Related Publications" on page 6 for information about installing the BlackDiamond and Summit switches mentioned in this guide.

The information in this guide about compatible switches and components is current as of the date this guide was published. Support for specific cable and optical module types may have been added to other switches or components besides those listed in this guide. For current information about hardware support and the minimum required software for specific devices, refer to the hardware and software compatibility matrix at:

http://www.extremenetworks.com/go/hw_sw_matrix

Conventions

Table 1 and Table 2 list conventions used in Extreme Networks publications.

Table 1: Notice Icons

Icon	Notice Type	Alerts you to . . .
	Note	Important features or instructions.
	Caution	Risk of personal injury, system damage, or loss of data.
	Warning	Risk of severe personal injury.

Table 2: Text Conventions

Convention	Description
`Screen displays`	This typeface represents information as it appears on the screen, or command syntax.
Words in *italicized* type	Italics emphasize a point of information or denote new terms at the place where they are defined in the text. Book titles are printed in italics.

Related Publications

The Extreme Networks ExtremeXOS® switch documentation set includes:

- *ExtremeXOS Concepts Guide*
- *ExtremeXOS Command Reference Guide*
- *ExtremeXOS Release Notes*
- *Extreme Networks BlackDiamond 8800 Series Switches Hardware Installation Guide*
- *Extreme Networks BlackDiamond 12800 Series Switches Hardware Installation Guide*
- *Extreme Networks BlackDiamond 10808 Switch Hardware Installation Guide*
- *Extreme Networks BlackDiamond 20800 Series Switches Hardware Installation Guide*
- *Extreme Networks Summit Family Switches Hardware Installation Guide*
- *Extreme Networks Pluggable Interface Modules Installation Guide* (this guide)

Hardware and software documentation for Extreme Networks products is available from the Extreme Networks web site at the following location:

http://www.extremenetworks.com/go/documentation

You can download software concepts guides and reference guides, hardware installation guides, and other documents.

Under your product warranty or with a current support contract, you can access software release notes from the eSupport web pages at:

https://esupport.extremenetworks.com/

NOTE

You must have an active support agreement or a product registered to you in order to receive an eSupport login and access to Extreme Networks software release notes.

To request an eSupport user name and password, select the Request Web Login link on the eSupport home page at:

https://esupport.extremenetworks.com

You can see complete information about all of our services online at:

http://www.extremenetworks.com/solutions/service-solutions.aspx

For a services proposal in EMEA, contact your Extreme Networks supplier or Extreme Networks sales representative. In the Americas, Japan, and the Asia-Pacific, send an email to servicesales@extremenetworks.com. A service representative will respond to you within one business day.

1 CHAPTER Extreme Networks SFP and SFP+ Modules

This chapter includes the following sections:

- Overview of SFP and SFP+ Modules on page 9
- Types of Optical SFP and SFP+ Interfaces on page 10
- 10/100/1000BASE-T Copper SFP Module on page 18
- Preparing to Install or Replace an SFP Module on page 18
- Installing an SFP Module on page 18
- Connecting Fiber Cables on page 20
- Removing an SFP Module on page 21

Overview of SFP and SFP+ Modules

Extreme Networks switches support small form factor pluggable (SFP) interface modules, also known as mini-GBICs. Extreme Networks switches support both optical and copper SFP and SFP+ modules. The types of switches and the I/O modules determine the compatible type of SFP or SFP+ module.

Use only Extreme Networks-certified SFP and SFP+ modules, available from Extreme Networks, in the SFP port on the switch or I/O module.

Types of Optical SFP and SFP+ Interfaces

Extreme Networks switches support the following types of optical SFP and SFP+ interfaces:

- SX SFP module (see page 10)
- LX SFP module (see page 11)
- ZX SFP module (see page 12)
- 1000BASE-BX bidirectional SFP modules (see page 13)
  - 1000BASE-BX-D
  - 1000BASE-BX-U
- 100FX SFP module for Gigabit Ethernet ports (see page 13)
- Dual-speed 100FX/1000LX SFP module (see page 14)
- LX100 SFP module (see page 15)
- 100BASE-LX10 SFP module (see page 15)
- 100BASE-BX bidirectional SFP modules (see page 16)
  - 100BASE-BX-D
  - 100BASE-BX-U
- 100FX SFP module for 100-Mbps Ethernet (fast Ethernet) ports (see page 16)
- SR SFP+ (see page 16)
- LR SFP+ (see page 17)
- ER SFP+ (see page 17)
- LRM SFP+ (see page 17)

The information in this guide about hardware platform support for each type of SFPs is current as of the date this guide was published. Support for specific SFP types may have been added to other switches or I/O modules besides those listed in this guide. For current information about hardware support and the minimum required software for SFPs, refer to the most recent version of the ExtremeXOS release notes.

Technical specifications for all SFP modules are listed in Appendix B.

SX SFP Module

The SX SFP module provides a 1000BASE-X optical connection using LC connectors and multimode fiber cable up to 550 meters long. The SX SFP module conforms to the 1000BASE-SX standard.

SX SFP modules are supported in the following Extreme Networks switches:

- BlackDiamond 10808
- BlackDiamond 8800 series
- BlackDiamond 12800 series
- BlackDiamond 20800 series
- Summit X150 series
- Summit X250e series
- Summit X450 series
- Summit X450a series

- Summit X450e series
- Summit X460 series
- Summit X480 series
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series
- Summit WM3000 series controllers

Optical Budget Calculation

When you plan an installation using the SX SFP module, Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors and operating margin. There is no minimum attenuation or minimum cable length restriction.

For technical specifications for the SX SFP, see Appendix B.

LX SFP Module

The LX SFP module provides a 1000BASE-X optical connection using LC connectors and single-mode fiber (SMF) cable up to 10 km long. The LX SFP module conforms to the 1000BASE-LX standard.

LX SFP modules are supported on the following Extreme Networks switches:

- BlackDiamond 10808
- BlackDiamond 8800 series
- BlackDiamond 12800 series
- BlackDiamond 20800 series
- Summit X150 series
- Summit X250e series
- Summit X450 series
- Summit X450a series
- Summit X450e series
- Summit X460 series
- Summit X480 series
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series

Optical Budget Calculation

Measure cable plant losses with a 1310 nm light source and verify this to be within budget. When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example 0.25 dB/km), Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors, and operating margin. There is no minimum system budget or minimum cable length restriction because the maximum receive power is the same as the maximum transmit power. There is no minimum attenuation or minimum cable length restriction.

For technical specifications for the LX SFP, see Appendix B.

ZX SFP Module

The ZX SFP module is a long-haul SFP that provides a 1000BASE-X optical connection using LC connectors and SMF cable up to 80 km long.

ZX SFP modules are supported on the following Extreme Networks switches:

- BlackDiamond 10808
- BlackDiamond 8800 series
- BlackDiamond 12800 series
- BlackDiamond 20800 series
- Summit X150 series
- Summit X250e series
- Summit X450 series
- Summit X450a series
- Summit X450e series
- Summit X460 series
- Summit X480 series
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series

Optical Budget Calculation

Measure cable plant losses with a 1550 nm light source and verify this to be within budget. When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example, 0.25 dB/km), Extreme Networks recommends that you reserve 3 dB of the total budget for losses induced by cable splices or connectors and operating margin. A minimum system budget or attenuation is required to prevent saturation of the receiver.

For technical specifications for the ZX SFP, see Appendix B.

1000BASE-BX Bi-Directional SFP Modules

The 1000BASE-BX SFP modules include the 1000BASE-BX-U SFP module and the 1000BASE-BX-D SFP module. These two SFP modules are used together to permit a bidirectional Gigabit Ethernet connection using a single strand of SMF cable and LC connectors. The 1000BASE-BX-D SFP operates at wavelengths of 1490 nm TX/1310 nm RX, and the 1000BASE-BX-U SFP operates at wavelengths of 1310 nm TX/1490 nm RX. The 1000BASE-BX-U SFP module is always connected to the 1000BASE-BX-D SFP module. The maximum transmission distance for this connection is 10 km. The 1000BASE-BX SFP modules conform to the IEEE 802.3ah 1000BASE-BX10 standard.

The 1000BASE-BX SFP modules are supported on the following Extreme Networks switches:

- BlackDiamond 10808
- BlackDiamond 8800 series
- BlackDiamond 12800 series
- BlackDiamond 20800 series
- Summit X150 series
- Summit X250e series
- Summit X450 series
- Summit X450a series
- Summit X450e series
- Summit X460 series
- Summit X480 series
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports

For technical specifications for the 1000BASE-BX SFP, see Appendix B.

100FX SFP Module for Gigabit Ethernet Ports

The 100FX SFP module for Gigabit Ethernet (GE) ports (Model # 10063) provides optical links up to 2 km long using multimode fiber cable. The 100FX SFP for GE ports conforms to the 100FX-MMF standard.

The 100FX SFP modules are supported in the following Extreme Networks switches:

- BlackDiamond 8800 series
  - G24x I/O module
  - MSM-G8x module
  - G48Xa I/O module
- BlackDiamond 20800 series
- Summit X450-24x switch: ports 5 through 24 (not supported on combination ports)
- Summit X450a-24x, X450a-24xDC switches: ports 1 through 20 (not supported on combination ports)

For technical specifications for the 100FX SFP for Gigabit Ethernet ports, see Appendix B.

Dual-speed 100FX/1000LX SFP Module

The dual-speed 100FX/1000LX SFP module operates at either 100 Mbps or 1000 Mbps over SMF links up to 10 km long. Operating at 100 Mbps, the dual-speed SFP conforms to the 100BASE-LX standard. Operating at 1000 Mbps, the dual-speed SFP conforms to the 1000BASE-LX standard.

The dual-speed 100FX/1000FX SFP modules are supported in the following Extreme Networks switches:

- BlackDiamond 8800 series
- BlackDiamond 12800 series
- BlackDiamond 20800 series
- Summit X450-24x switch: ports 5 through 24 (not supported on combination ports)
- Summit X450a-24x, X450a-24xDC switches: ports 1 through 20 (not supported on combination ports)

Optical Budget Calculation

The 100FX/1000LX SFP module complies with the 100FX-SMF standard. To use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Next, connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

When in SMF operation, 100FX-SMF or 1000LX, measure cable plant losses with a 1310 nm light source and verify this to be within budget. When you calculate the maximum distance attainable using optical cable with a specified loss per kilometer (for example 0.25 dB/km), Extreme Networks recommends that 3 dB of the total budget be reserved for losses induced by cable splices or connectors and operating margin.

NOTE

The 100FX/1000LX SFP module detects link status based only on the presence of light in the receive cable. Therefore, if a single strand is broken, the link partner on the other port will not detect link down.

For technical specifications for the 100FX/1000LX SFP, see Appendix B.

LX100 SFP Module

The LX100 SFP module provides a 1000BASE-X optical link up to 100 km long using LC connectors and SMF cable.

The LX-100 SFP modules are supported on the following Extreme Networks switches:

- BlackDiamond 8800 series
- BlackDiamond 10808
- BlackDiamond 12800 series
- BlackDiamond 20800 series
- Summit X150 series
- Summit X250e series
- Summit X450 series
- Summit X450a series
- Summit X450e series
- Summit X460 series
- Summit X480 series
- Summit X650-24x switch: ports 1 through 22, VIM1 module ports
- Summit X670 series

For technical specifications for the LX100 SFP, see Appendix B.

100BASE-LX10 SFP Module

The 100BASE-LX10 SFP module provides a 100-Mbps optical connection using LC connectors and SMF cable. The maximum transmission distance for this connection is 10 km.

The LX10 SFP module is supported in the following Extreme Networks switches:

- Summit X250e series: all ports
- Summit X150 series: combination ports only
- Summit X460 series
- Summit X480 series

For technical specifications for the 100BASE-LX10 SFP, see Appendix B.

100BASE-BX Bi-Directional SFP Modules

The 100BASE-BX SFP modules include the 100BASE-BX-U SFP module and the 100BASE-BX-D SFP module. These two SFP modules are used together in a Summit family switch to permit a bidirectional 100-Mbps Ethernet connection using a single strand of SMF cable and LC connectors. The 100BASE-BX-U SFP module is always connected to the 100BASE-BX-D SFP module. The 100BASE-BX-D SFP operates at wavelengths of 1550-nm TX/1310-nm RX wavelength), and the 1000BASE-BX-U SFP operates at wavelengths of 1310 nm TX/1550 nm RX. The maximum transmission distance for this connection is 10 km. The 100BASE-BX SFP modules conform to the IEEE 802.3ah standard.

The 100BASE-BX SFP modules are supported in the following Extreme Networks switches:

- Summit X250e series: all ports
- Summit X150 series: combination ports only

For technical specifications for the 100BASE-BX bi-directional SFP, see Appendix B.

100FX SFP Module for Fast Ethernet Ports

The 100FX SFP module for fast Ethernet (FE) ports (Model # 10067) provides a 100-Mbps optical link using LC connectors and 1310-nm multimode fiber (MMF) cable. The maximum transmission distance for this connection is 2 km.

The 100FX SFP module for FE ports is supported in the following Extreme Networks switches:

- Summit X250e series switches: all ports
- Summit X150 series switches: combination ports only

For technical specifications for the 100FX SFP module for fast Ethernet ports, see Appendix B.

SR SFP+ Module

The SR SFP+ module provides a 10-Gbps optical connection using LC connectors and multimode fiber cable up to 300 meters long. The SR SFP+ module conforms to the 10GBASE-SR standard.

The SR SFP+ module is supported in the following Extreme Networks switches and modules:

- Summit X650-24x switch
- VIM1-10G8X versatile interface module for the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670 series

For technical specifications for the SR SFP+, see Appendix B.

LR SFP+ Module

The LR SFP+ module provides a 10-Gbps optical connection using LC connectors and single-mode fiber cable up to 10 kilometers long. The LR SFP+ module conforms to the 10GBASE-LR standard.

The LR SFP+ module is supported in the following Extreme Networks switches:

- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module for the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670 series

For technical specifications for the LR SFP+, see Appendix B.

ER SFP+ Module

The ER SFP+ module provides a 10-Gbps optical connection using LC connectors and single-mode fiber cable up to 40 kilometers long. The ER SFP+ module conforms to the 10GBASE-ER standard.

The ER SFP + module is supported in the following Extreme Networks switches:

- BlackDiamond 8800 series
- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module for the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670 series

For technical specifications for the ER SFP+, see Appendix B.

LRM SFP+ Module

The LRM SFP+ module provides a 10-Gbps optical connection using LC connectors and multimode fiber cable up to 220 meters long. The LRM SFP+ module conforms to the 10GBASE-LRM standard.

The LRM SFP+ module supports link lengths of 220 meters on legacy multimode fiber (MMF) cable. To ensure that specifications are met over Fiber Distributed Digital Interface (FDDI) grade OM1 and OM2 fibers, the transmitter should be coupled through a mode conditioning patch cord. No mode conditioning patch cord is required for applications over OM3 fiber.

The LRM SFP+ is supported in the following Extreme Networks switches:

- BlackDiamond 8800 series
- Summit X650-24x switch (ports 1 through 24 on the front panel)
- VIM1-10G8X versatile interface module for the Summit X650 series switches
- XGM2-2sf option card in the Summit X350, X450a, and X450e series switches
- XGM3-2sf option card in the Summit X460 series switches
- Summit X670V-48x switch

For technical specifications for the LRM SFP+, see Appendix B.

10/100/1000BASE-T Copper SFP Module

The Extreme Networks 10/100/1000BASE-T copper SFP module is compatible with the Gigabit Ethernet standard and 1000 Base-T standard as specified in the IEEE 802.3ab standard. This SFP module provides a 100-Mbps connection using Category 5 cable.

The 10/100/1000BASE-T SFP module is supported in the following Extreme Networks switches:

- BlackDiamond 8800 series
- Summit X450 series (not supported on combination ports)
- Summit X450a series (not supported on combination ports)
- Summit X450e series (not supported on combination ports)
- Summit X650 series
  - Summit X650-24x switch: ports 1 through 22, VIM1 module ports
  - Summit X650-24t switch: VIM1 module ports
- Summit X670-48x switch

For technical specifications for the 10/100/1000BASE-T copper SFP, see Appendix B.

Preparing to Install or Replace an SFP Module

Complete the following tasks before inserting the SFP module:

1. Inspect and clean the fiber tips, coupler, and connectors.
2. Prepare and clean an external attenuator, if needed.

When handling fiber cables, take the following precautions to prevent damage to the cables:

- Do not stretch the fiber.
- Make sure the bend radius of the fiber is not less than 2 inches (5.08 cm).

Extreme Networks recommends the following guidelines when installing or replacing SFP modules on an active network:

- Use the same type of SFP module at each end of the link, except for the 1000BASE-BX and 100BSE-BX bi-directional SFP modules. The bi-directional SFP modules include a D-type and a U-type. You must use one D-type SFP and one U-type SFP together to allow for a single fiber bidirectional connection.
- Connect one end of the link to the Tx port. Without an attenuator, measure the total loss from the Tx port to the other site of the link. The total loss must not exceed the total optical system budget.

Installing an SFP Module

You can add or remove SFP modules in your switch without powering off the system. Figure 1 and Figure 2 show the types of SFP modules and connectors.

NOTE

The bi-directional SFP modules combine two SFP optical devices that must be used as a pair to establish the bidirectional connection over a single fiber. Module C and Module D in Figure 1 show the pair of SFPs for a bi-directional SFP module.

WARNING!

Optical SFPs contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1 A2:2001.

Figure 1: Optical SFP Module Types and Connectors

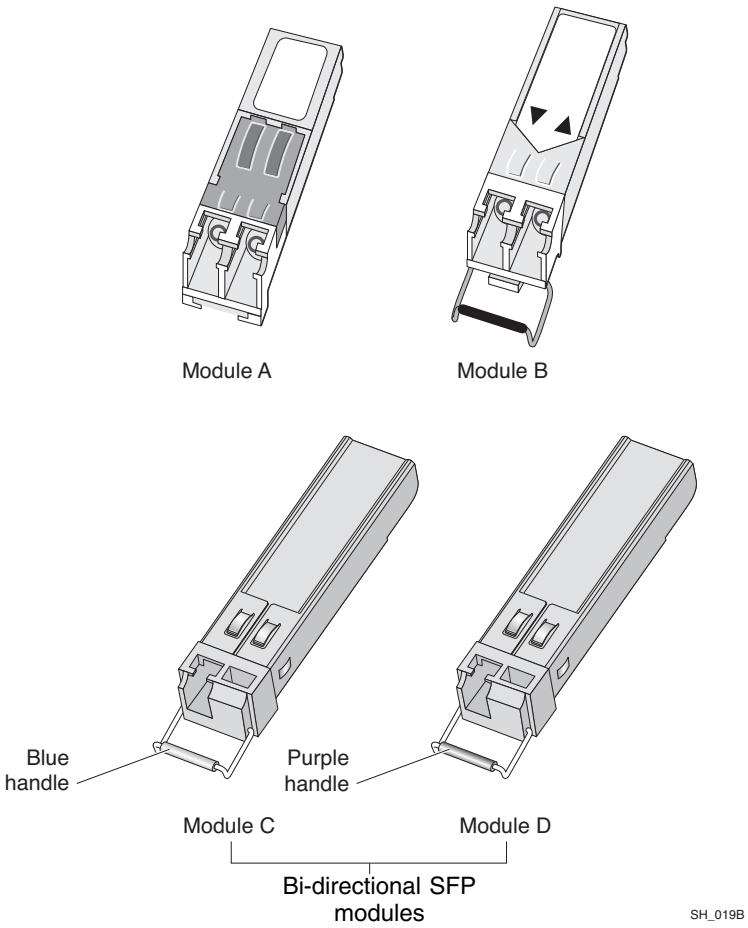
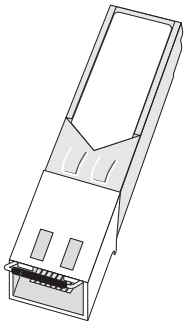


Figure 2: Copper SFP Module



BD_172

CAUTION

To prevent ESD damage to an SFP module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.

To insert an SFP module:

1 Holding the SFP module by its sides, insert the SFP module into the port on the switch.

2 Slide the SFP module into the port until you hear it click. If the SFP module has a handle, push up on the handle to secure the SFP module.

NOTE

Disconnect fiber-optic cable from an optical SFP module before removing the SFP module from the port.

Connecting Fiber Cables

Before you connect fiber cables to the dual-speed 100FX/1000LX SFP module or the LX100 SFP module, note the following information about these SFP modules.

100FX/1000LX SFP Module

The 100FX/1000LX SFP module complies with the 100FX-SMF standard. In order to use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Then connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

LX100 SFP Module

To prevent permanent damage to the LX100 SFP module, always check the optical input power of the receiver before you insert the fiber cable. The maximum optical input power is -9 dBm. If you use an optical loopback for diagnostics, the loopback requires a minimum of 12 dB optical attenuation. The recommended attenuation range is 12 to 20 dB.

Removing an SFP Module

To remove an SFP module:

1. Disconnect the optical cable from the SFP module.
2. Unlatch the SFP module in one of the following ways:
   - On an SFP module similar to Module A in Figure 1, press and hold the black plastic tab at the bottom of the connector.
   - On an SFP module similar to Module B, Module C, or Module D in Figure 1, rotate the front handle down.
3. Pull the SFP module out of the port on the switch.

2 QSFP+ Modules

CHAPTER

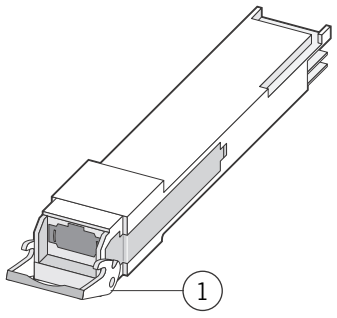
This chapter provides information about quad small form factor pluggable (QSFP+) transceivers or modules, and includes the following sections:

- Overview on page 23
- SR4 QSFP+ Module on page 24
- Installing a QSFP+ Module on page 24
- Removing a QSFP+ Module on page 26

Overview

A QSFP+ module (Figure 3) provides four 10-gigabit transmit and receive channels in a single pluggable optical module, for an aggregate bandwidth of 40 Gbps. QSFP+ modules are used in Extreme Networks BlackDiamond and Summit switches.

Figure 3: QSFP+ Optical Module



1 = Release handle

You can insert or remove QSFP+ modules without powering down the system.

The information in this guide about hardware platform support for QSFP+ modules is current as of the date this guide was published. Support for QSFP+ modules may have been added to other switches or I/O modules besides those listed in this guide. For current information about hardware support and the minimum required software for QSFP+ modules, refer to the most recent version of the *ExtremeXOS Release Notes*.

SR4 QSFP+ Module

The SR4 QSFP+ R4 module provides a 40-Gbps optical connection using MTP® (MPO) optical connectors. This optical module integrates four data lanes in each direction with 40 Gbps aggregate bandwidth. Each lane can operate at 10.3125 Gbps up to 100 meters using OM3 fiber or up to 150 meters using OM4 fiber. The SR4 QSFP+ module conforms to the 802.3ba D3.2 (40GBASE-SR4) standard.

The SR4 QSFP+ module is supported in the following Extreme Networks switches and components:

- SummitStack-V80 stacking module installed in a Summit X460 series switch
- VIM2-SummitStack-V80 module installed in a Summit X480 series switch
- VIM4-40GX module installed in a Summit X670V-48x switch
- BlackDiamond 8900-40G6X-xm I/O module

For technical specifications for the QSFP+ module, see Appendix B.

Installing a QSFP+ Module

You can install or remove QSFP+ modules in your switch without powering off the system.

WARNING!

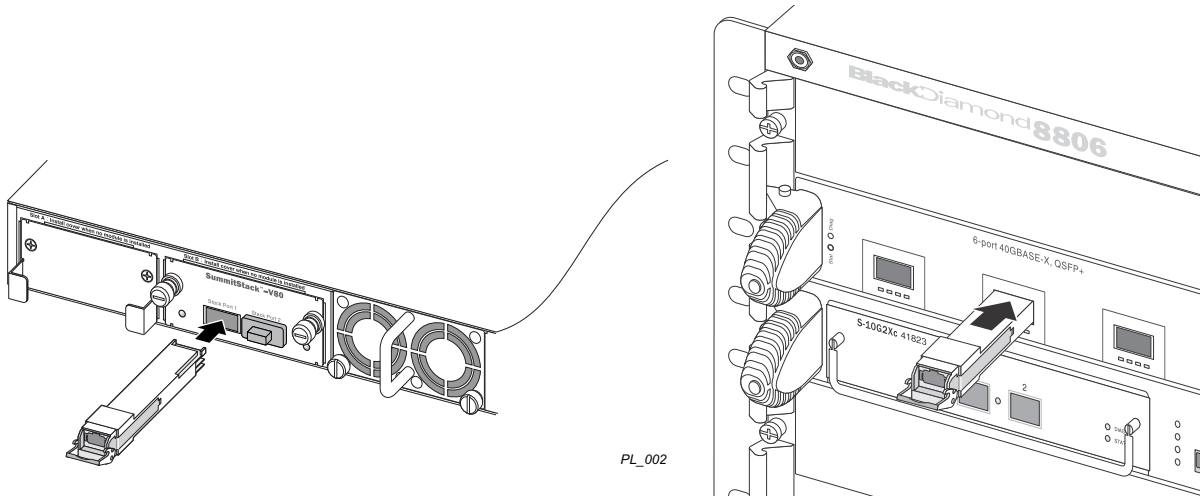
QSFP+ modules contain Class 1M lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with IEC 60825-1 Amendment 2 and CFR 21 Section 1040.

To install a QSFP+ module:

1. Remove the QSFP+ module from its antistatic container and remove the dust covers from the module optical connector.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.
2. Remove any rubber dust covers from the port where you are installing the QSFP+ module.
3. Holding the QSFP+ module by its sides, insert the QSFP+ module into the port on the switch or module (Figure 4).

Figure 4: Installing a QSFP+ Module

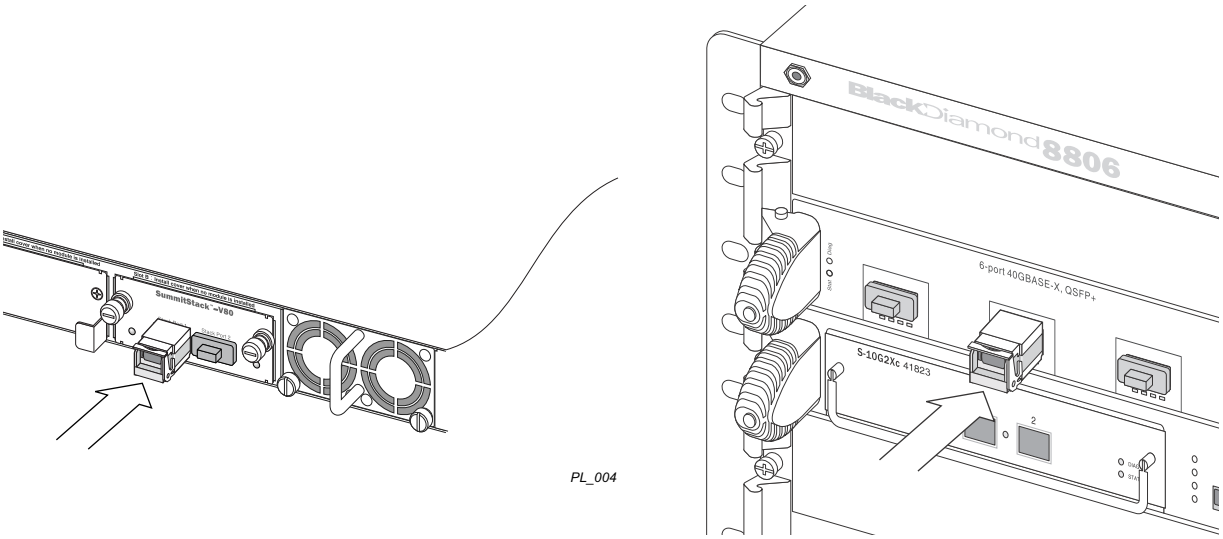


Summit family switch

BlackDiamond 8800 series switch

4 Slide the QSFP+ module into the port until you hear it click into place (Figure 4 and Figure 5). Push up on the handle to secure the QSFP+ module in the switch.

Figure 5: Installed QSFP+ Module



Summit family switch

BlackDiamond 8800 series switch

5 If you are installing only one QSFP+ module, make sure that all unoccupied ports are covered with a rubber dust cover, which is shipped with the Summit option card or BlackDiamond I/O module (Figure 5).

Removing a QSFP+ Module

You can remove a QSFP+ module from your Extreme Networks switch without powering off the system.

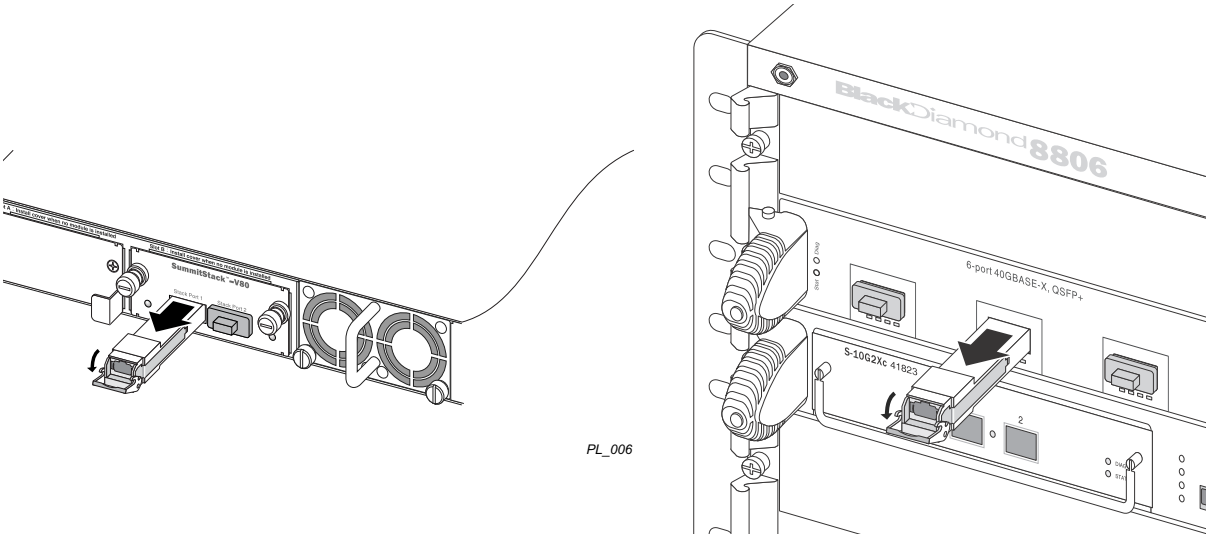
NOTE

Disconnect fiber-optic cable from a QSFP+ module before removing the QSFP+ module from the port.

To remove a QSFP+ module:

1 Rotate the handle (bail latch) on the QSFP+ module downward (Figure 6).

Figure 6: Removing a QSFP+ Module



Summit family switch

BlackDiamond 8800 series switch

2 Pull the connector out of the port.

3 Direct-Attach Cables

CHAPTER

Direct-attach copper and fiber cables provide connections between unpopulated SFP+ and QSFP+ ports. This chapter describes direct-attach cables that are used with Extreme Networks optical modules and includes the following sections:

- Types of Direct-Attach Cables on page 27
- SFP+ Direct-Attach Passive Cable on page 28
- QSFP+ Direct-Attach Cables on page 31

Regulatory compliance information for all cables is listed in Appendix B.

Types of Direct-Attach Cables

Extreme Networks switches support three types of direct-attach cables that connect to SFP+ or QSFP+ modules:

- SFP+ direct-attach passive cable
- QSFP+ direct-attach passive copper cable
- QSFP+ direct-attach active fiber cable

The types of switches and the I/O modules determine the compatible type of direct-attach cable.

Use only Extreme Networks-certified cables, available from Extreme Networks, to make connections to the SFP+ or QSFP+ port on the switch or I/O module.

You can connect or disconnect direct-attach cables without powering down the system.

SFP+ Direct-Attach Passive Cable

The SFP+ direct-attach passive cable (Figure 7) provides a 10-Gbps copper connection between unpopulated SFP+ ports. The cable is available in lengths from 1 meter to 10 meters and is terminated in connectors that are inserted directly into the SFP+ cages in place of optical SFP+ modules.

Figure 7: Types of SFP+ Direct-Attach Cable

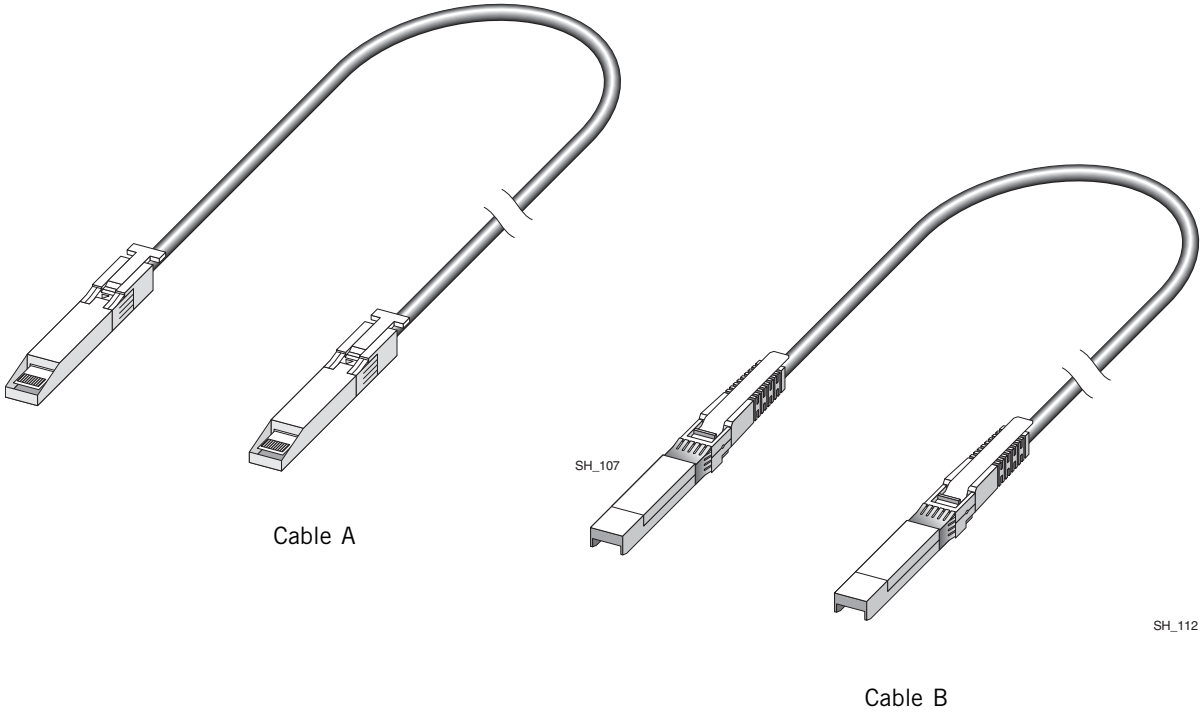


Table 3 lists the available SFP+ direct-attach cables and their model numbers.

Table 3: SFP+ Direct-Attach Cables

Model Number	Length
10304	1 meter
10305	3 meters
10306	5 meters
10307	10 meters

The SFP+ direct-attach cable is compatible with the following Summit switches and components:

- Summit X650-24x switch (front ports)
- VIM1-G8X versatile interface module in a Summit X650 series switch
- XGM2-2sf option card installed in a Summit X350 series, X450a series, or X450e series switch
- Summit X670-48x series switches (front ports)
- XGM3-2sf option card installed in a Summit X460 series switch
- S-10G2Xc card in a BlackDiamond 8000 series MSM

Connecting an SFP+ Direct-Attach Cable

To connect an SFP+ direct-attach cable:

1 Holding the SFP+ connector by its sides, insert the connector into the port on the switch (Figure 8 and Figure 9).

Figure 8: Connecting an SFP+ Direct-Attach Cable to a Front-Panel Port

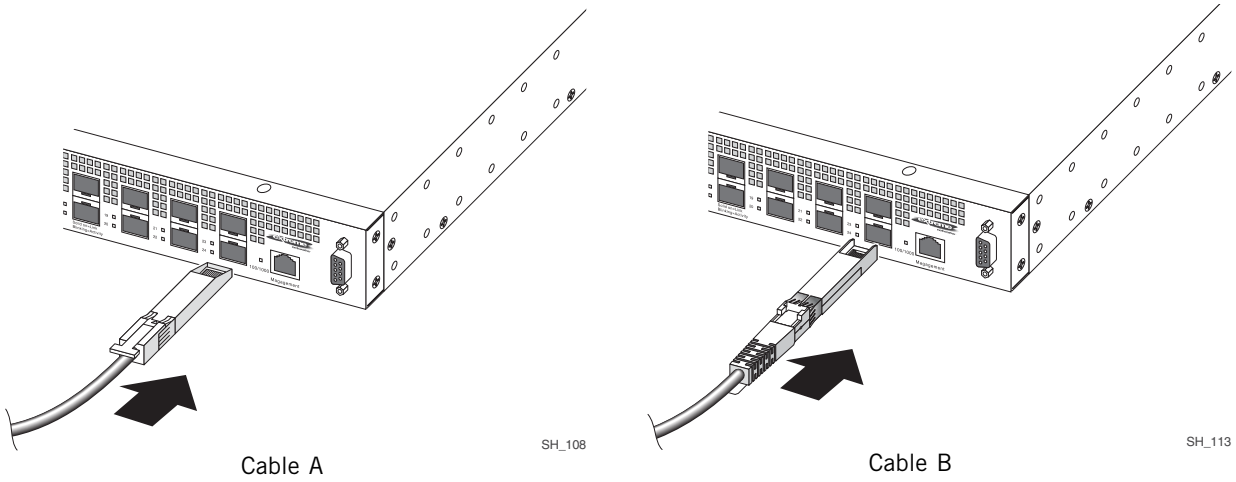
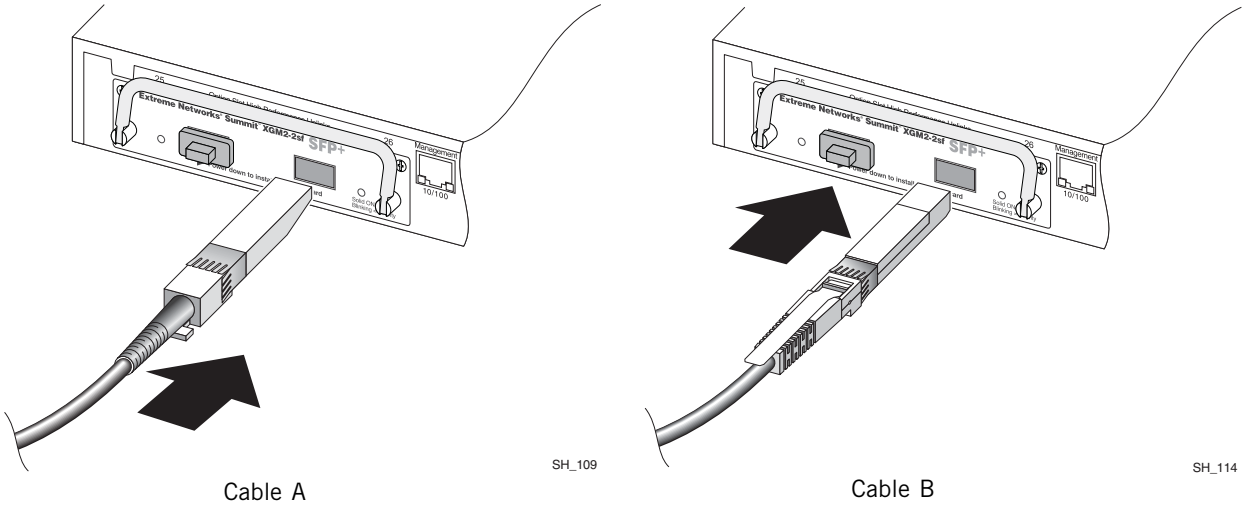


Figure 9: Connecting an SFP+ Direct-Attach Cable to an XGM2-2sf Option Card



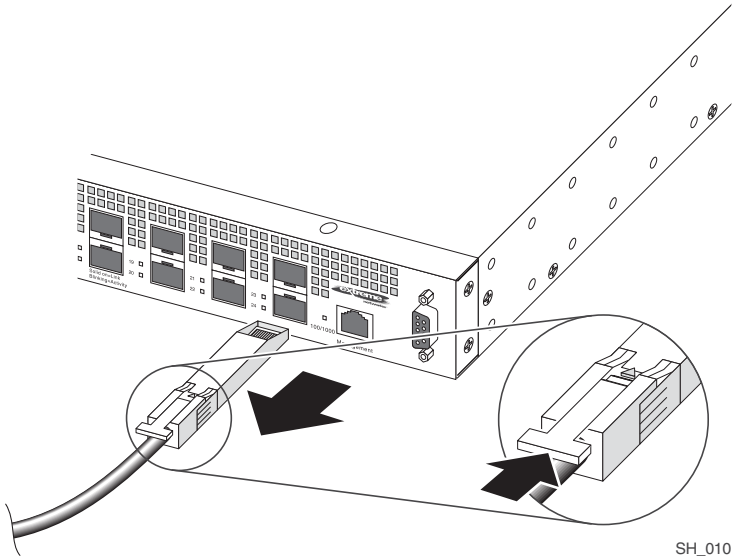
2 Slide the connector into the port until you hear it click into place.

Disconnecting an SFP+ Direct-Attach Cable

To remove an SFP+ direct-attach cable:

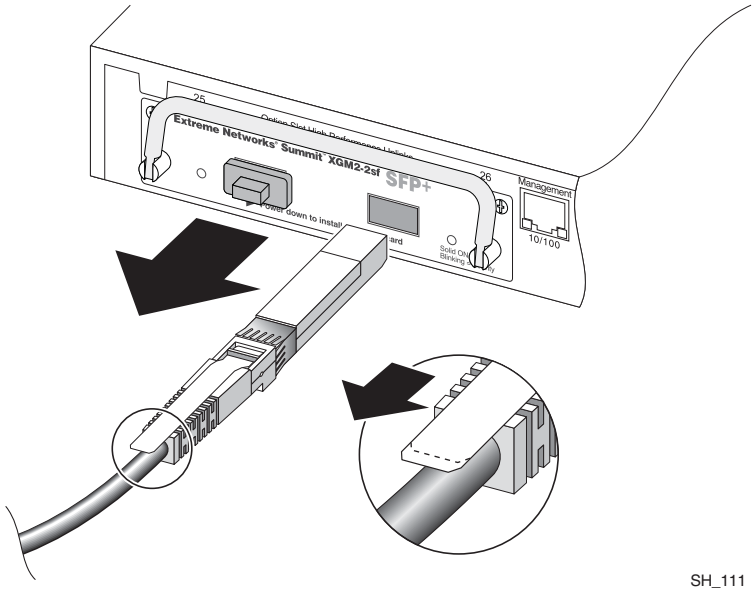
1 If the cable connector is similar to cable A in Figure 7, push the release latch toward the port on the switch (see Figure 10).

Figure 10: Disconnecting an SFP+ Direct-Attach Cable (Cable A)



If the connector is similar to cable B in Figure 7, pull the tab away from the switch port (Figure 11).

Figure 11: Disconnecting an SFP+ Direct-Attach Cable (Cable B)

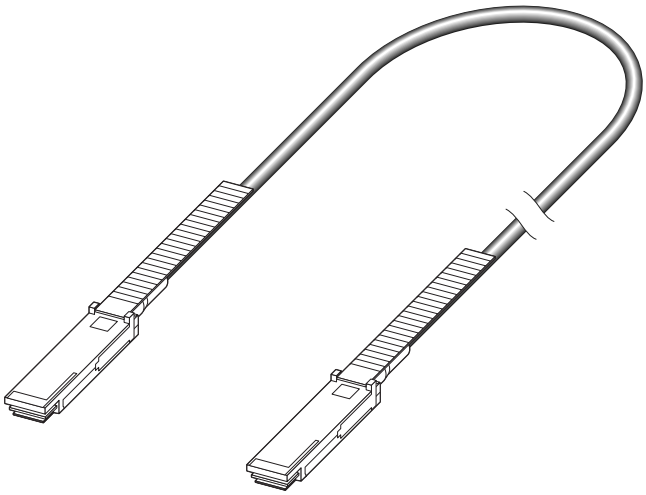


2 Pull the connector out of the port.

QSFP+ Direct-Attach Cables

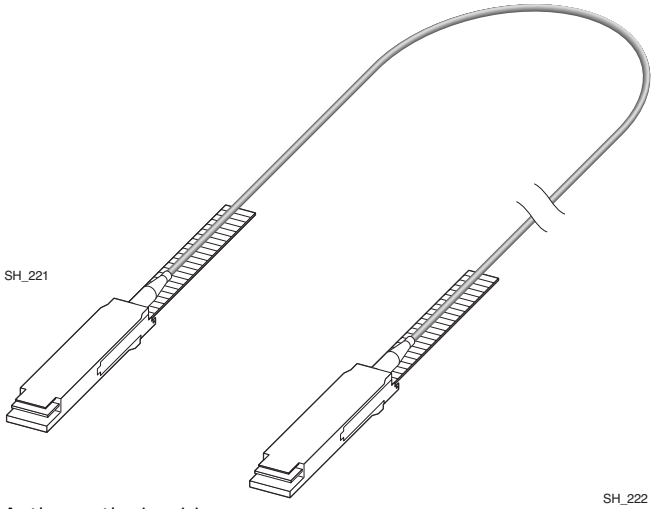
The QSFP+ direct-attach cables (Table 12) provide a 40-Gbps (4 x 10-Gbps) bidirectional copper or optical connection between unpopulated QSFP+ ports. These cables are available in lengths from 0.5 meter to 100 meters and are terminated in connectors that are inserted directly into the QSFP+ cages in place of optical QSFP+ modules.

Figure 12: Types of QSFP+ Direct-Attach Cable



Passive copper cable

SH_221



SH_222

Active optical cable

Table 4 lists the available QSFP+ direct-attach cables and their model numbers.

Table 4: QSFP+ Direct-Attach Cables

Cable Description	Model Number	Length
QSFP+ passive copper cable	10311	0.5 meter
	10312	1 meter
	10313	3 meters
QSFP+ active optical cable	10315	10 meters
	10318	100 meters

The QSFP+ direct-attach cable is compatible with the following Extreme Networks switches and components:

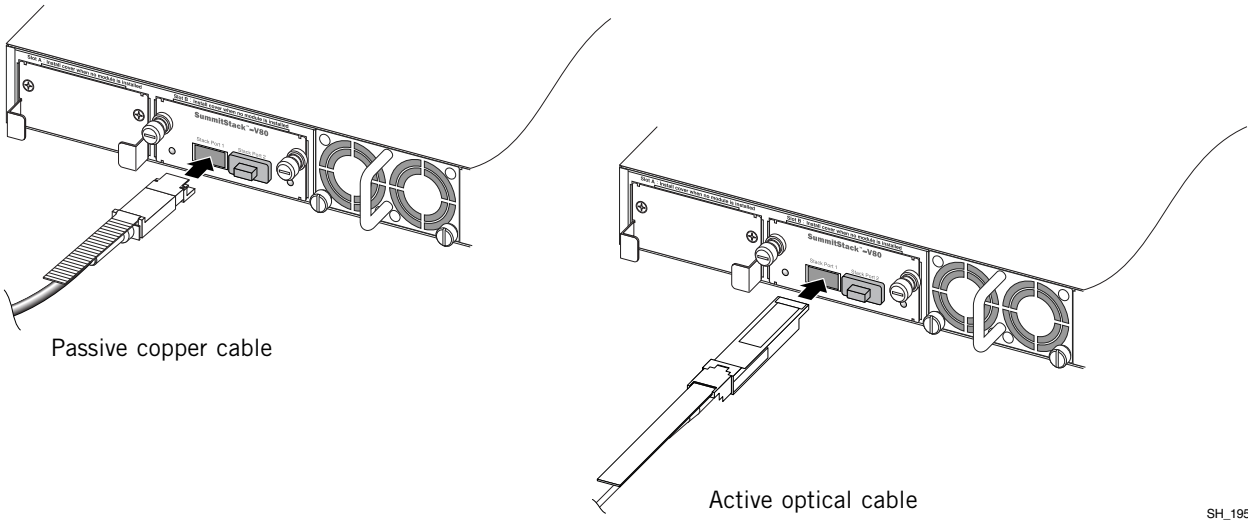
- SummitStack-V80 stacking module installed in a Summit X460 series switch
- VIM2-SummitStack-V80 module installed in a Summit X480 series switch
- BlackDiamond 8900-40G6X-xm I/O module
- VIM3-40G4X module installed in a Summit X650 series switch
- VIM4-40G4X module installed in a Summit X670V series switch

Connecting a QSFP+ Direct-Attach Cable

To connect a QSFP+ direct-attach cable:

1 Holding the QSFP+ connector by its sides, insert the connector into the port on the switch (Figure 13).

Figure 13: Connecting a QSFP+ Direct-Attach Cable to a SummitStack-V80 Module



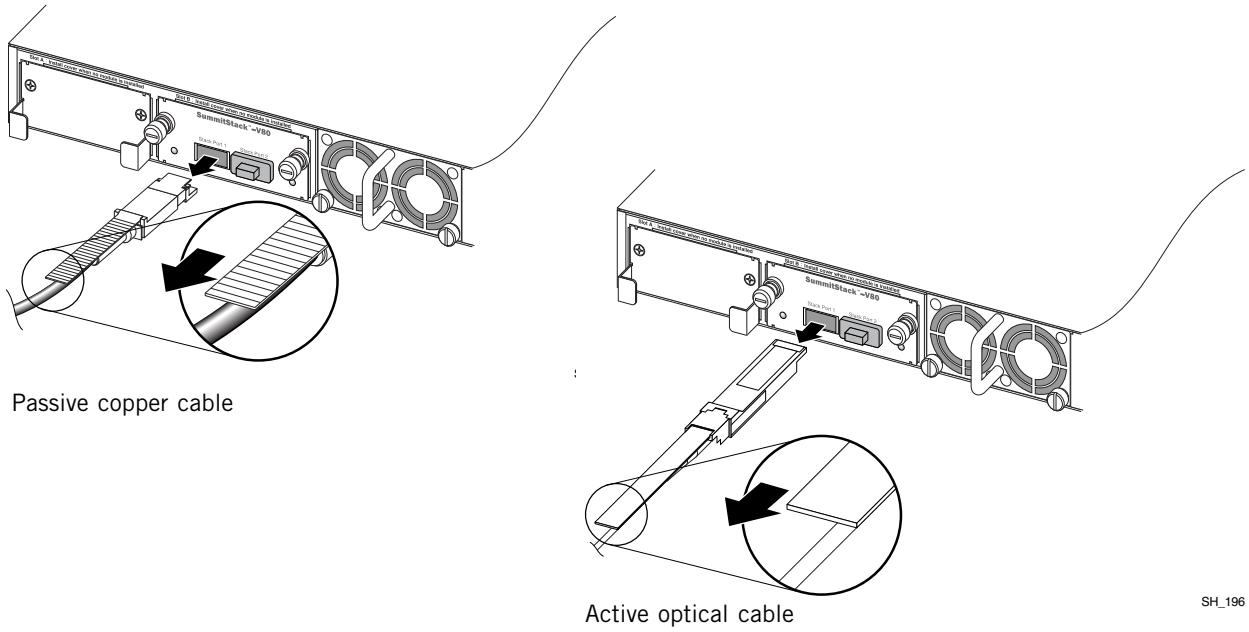
2 Push the connector into the port until you hear it click into place.

Disconnecting a QSFP+ Direct-Attach Cable

To remove a QSFP+ direct-attach cable:

1 Hold the connector firmly as you pull the release tab away from the stacking port (Figure 14).

Figure 14: Disconnecting a QSFP+ Direct-Attach Cable



2 Pull the connector out of the port.

4 CHAPTER Extreme Networks XFP Modules

This chapter includes the following topics:

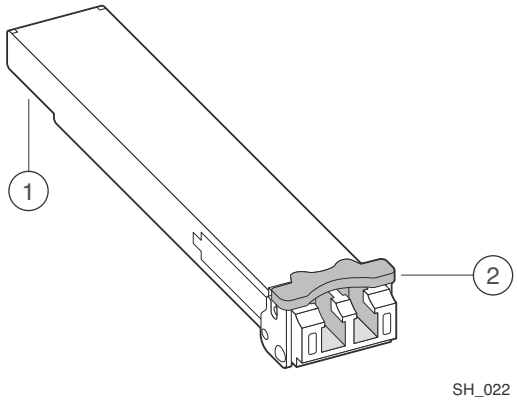
- Overview of XFP Modules on page 35
- Installing an XFP Module on page 36
- Removing an XFP Module on page 38

Overview of XFP Modules

XFP modules (Figure 15) are 10-gigabit modules that convert serial electrical signals to external serial optical or electrical signals. They are used in the following Extreme Networks switches:

- Summit X350, X450a, X450e, X460, and X480 series switches
- BlackDiamond 10G4Xa, 10G4Xc, and 10G8Xc I/O modules for the BlackDiamond 8800 series switches
- BlackDiamond GM-40XA, GM-40XB, and HM-2X24GA I/O modules for the BlackDiamond 20800 series switch

Figure 15: XFP Module



1 = Card edge connector
2 = Handle

XFP modules can be installed or replaced in an Extreme Networks switch or I/O module without powering off the system. All Extreme Networks XFP modules comply with IEEE 802.3ae standards and with the latest XFP multi-source agreement (MSA).

Extreme Networks switches and modules support the following types of XFP modules:

- LR XFP module

  The LR XFP module uses single-mode fiber (SMF) cable for links up to 10 km long. It has an LC duplex connector.
- SR XFP module

  The SR XFP module uses multimode fiber (MMF) cable for links up to 300 m long. It has an LC duplex connector.
- ER XFP module

  The ER XFP module uses SMF cable for links up to 40 km long. It has an LC duplex connector.
- ZR XFP modules

  The ZR XFP module uses SMF cable for links up to 80 km long. It has an LC duplex connector.
- Tunable DWDM XFP modules

  The tunable DWDM XFP module uses SMF cable for links up to 80 km long. It has an LC duplex connector.

For current information about hardware support for XFPs, refer to the most recent version of the *ExtremeXOS Release Notes*.

Technical specifications for XFP modules are listed in Appendix B.

Installing an XFP Module

This section describes how to install an XFP module. You can install or remove an XFP module in your Extreme Networks switch without powering off the system.

WARNING!

XFP modules contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10 and EN60825-1 A2:2001.

CAUTION

To prevent ESD damage to the XFP module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.

To install an XFP module:

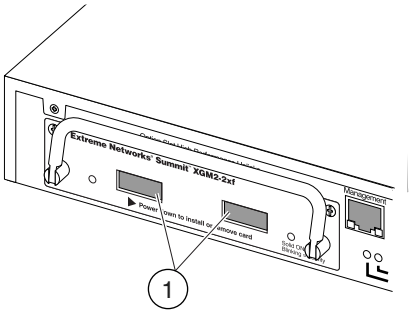
1 Remove the XFP module from its antistatic container and remove the dust covers from the module optical connectors.

  If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.

2 Remove any rubber dust covers from the port where you are installing the XFP module.

On a Summit option card, move the handle to an upright position to access the XFP ports (see Figure 16).

Figure 16: Accessing the XFP Ports



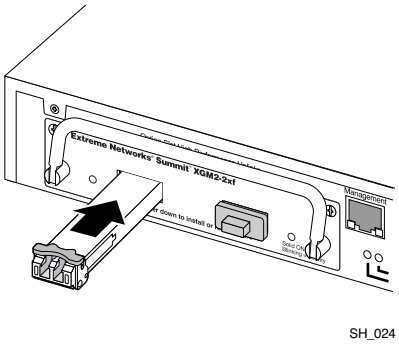
SH_023

1 = XFP ports

3 Make sure that the XFP handle (bail latch) is rotated all the way up (see Figure 17).

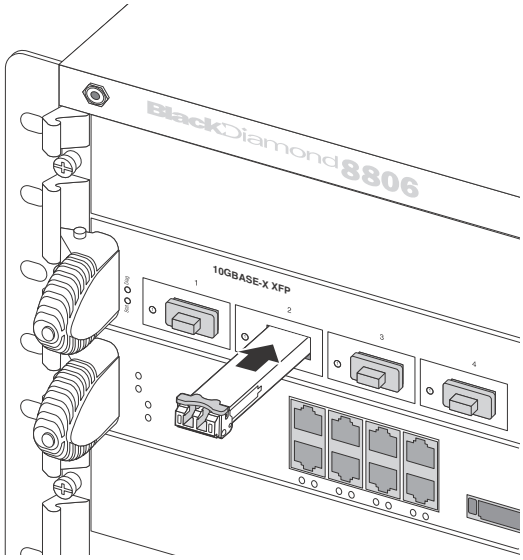
4 Holding the module by its sides, partially insert the XFP module into the XFP port (see Figure 17).

Figure 17: Installing an XFP Module



SH_024

Summit family switch

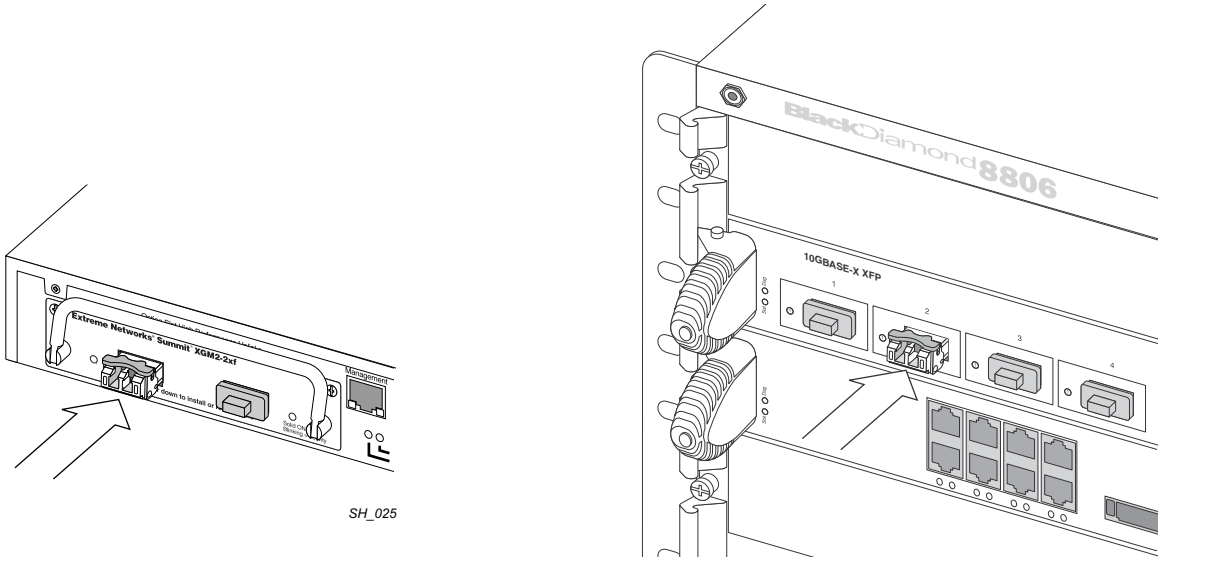


BD_175

BlackDiamond 8800 series switch

5 Slide the XFP module as far as possible into the slot until you hear it click, indicating that it is firmly attached (see Figure 17 and Figure 18).

Figure 18: Installed XFP Module



Summit family switch

BlackDiamond 8800 series switch

6 If you are installing only one XFP module, make sure that all unoccupied ports are covered with rubber dust covers, which are shipped with the option card or I/O module (see Figure 18).

NOTE

To prevent permanent damage to a ZR XFP or DWDM XFP, always check the optical input power of the receiver before inserting the fiber cable. The maximum optical input power for these XFPs is –7 dBm. If you use an optical loopback for diagnostics, the loopback requires a minimum of 15 dB optical attenuation. The recommended attenuation range is 15 to 20 dB.

NOTE

To ensure that your XFP module is undamaged upon installation, you can correlate factory test data with your installation site test data by consulting the average power reference values shown on the XFP module test data sheet (Part No. 121080-00) enclosed with the module.

Removing an XFP Module

You can remove an XFP module from your Extreme Networks switch or I/O module without powering off the system. The XFP module is shown in Figure 15 on page 35.

NOTE

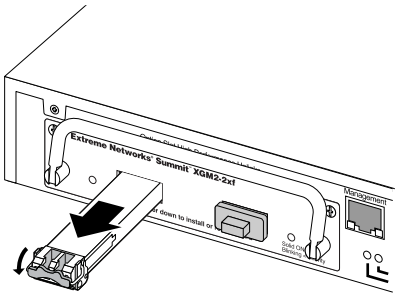
Disconnect fiber-optic cable from an XFP module before removing the XFP module from the port.

To remove an XFP module:

1 Rotate the handle (bail latch) on the XFP module downward (Figure 19).

2 Carefully pull the XFP module out of the port.

Figure 19: Removing an XFP Module



3 Place the dust covers back into the XFP module connectors.

4 Place the XFP module immediately into an antistatic container to protect it from ESD damage and dust.

5 CHAPTER Extreme Networks XENPAK Transceivers

This chapter provides information about the XENPAK optical transceiver modules used in Extreme Networks equipment and includes the following sections:

- Overview of XENPAK Modules on page 41
- Installing and Removing a XENPAK Module on page 45

Overview of XENPAK Modules

The BlackDiamond 8800 series switches, BlackDiamond 10808 switch, BlackDiamond 12800 series switches, and Summit family switches support several types of XENPAK transceiver modules. All of these modules conform to the 10 Gigabit Ethernet standard defined by the IEEE 802.3ae as applicable

CAUTION

XENPAK modules contain Class 1 laser devices. Invisible laser radiation can occur when the connectors are open. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10, 1040.11, and EN60825-1 A2:2001.

Extreme Networks switches and modules support the following types of XENPAK interfaces:

- SR XENPAK on page 42
- LR XENPAK on page 42
- ER XENPAK on page 43
- ZR XENPAK on page 43
- LX4 XENPAK on page 45
- LW XENPAK on page 44

NOTE

CX4 XENPAKs are also supported by Extreme Networks devices; contact your vendor to obtain these.

NOTE

Use only Extreme Networks-approved XENPAK modules in all Extreme Networks devices.

SR XENPAK

The SR XENPAK supports multimode fiber (MMF) cable and has SC connectors.

The SR XENPAK requires the software versions listed in Table 5.

Table 5: SR XENPAK Software Requirements

Switch Model	Required Software
BlackDiamond Switches	
BlackDiamond 10808	ExtremeXOS 11.1.1 or later
BlackDiamond 8800 series	ExtremeXOS 11.1.1 or later
BlackDiamond 12804	ExtremeXOS 11.4 or later
BlackDiamond 12802	ExtremeXOS 12.0 or later
Summit Switches	
Summit X450 series	ExtremeXOS 11.2.0 or later
Summit X450a series	ExtremeXOS 11.2.0 or later
Summit X450e series	ExtremeXOS 11.2.0 or later

For technical specifications for the SR XENPAK, see Appendix B.

LR XENPAK

The LR XENPAK supports single-mode fiber (SMF) cable and has SC connectors.

The LR XENPAK requires the software versions listed in Table 6.

Table 6: LR XENPAK Software Requirements

Switch Model	Required Software
BlackDiamond Switches	
BlackDiamond 10808	ExtremeXOS 11.1.1 or later
BlackDiamond 8800 series	ExtremeXOS 11.1.1 or later
BlackDiamond 12804	ExtremeXOS 11.4 or later
BlackDiamond 12802	ExtremeXOS 12.0 or later
Summit Switches	
Summit X450 series	ExtremeXOS 11.2.0 or later
Summit X450a series	ExtremeXOS 11.2.0 or later
Summit X450e series	ExtremeXOS 11.2.0 or later

For technical specifications for the LR XENPAK, see Appendix B

ER XENPAK

The ER XENPAK supports SMF cable and has SC connectors.

The ER XENPAK requires the software versions listed in Table 7.

Table 7: ER XENPAK Software Requirements

Switch Model	Required Software
BlackDiamond Switches	
BlackDiamond 10808	ExtremeXOS 11.1.1 or later
BlackDiamond 8800 series	ExtremeXOS 11.1.1 or later
BlackDiamond 12804	ExtremeXOS 11.4 or later
BlackDiamond 12802	ExtremeXOS 12.0 or later
Summit Switches	
Summit X450 series	ExtremeXOS 11.2.0 or later
Summit X450a series	ExtremeXOS 11.2.0 or later
Summit X450e series	ExtremeXOS 11.2.0 or later

For technical specifications for the ER XENPAK, see Appendix B.

ZR XENPAK

The ZR XENPAK supports SMF cable and has SC connectors.

The ZR XENPAK requires the software versions listed in Table 8.

Table 8: ZR XENPAK Software Requirements

Switch Model	Required Software
BlackDiamond Switches	
BlackDiamond 10808	ExtremeXOS 11.3.1 or later
BlackDiamond 8800 series	ExtremeXOS 11.3.1 or later
BlackDiamond 12804	ExtremeXOS 11.4 or later
BlackDiamond 12802	ExtremeXOS 12.0 or later
Summit Switches	
Summit X450 series	ExtremeXOS 11.3.1 or later
Summit X450a series	ExtremeXOS 11.3.1 or later
Summit X450e series	ExtremeXOS 11.3.1 or later

For technical specifications for the ZR XENPAK, see Appendix B.

WARNING!

To prevent permanent damage to the ZR XENPAK and other equipment: always check the optical input power of the receiver before inserting the fiber. The maximum optical input power for the receiver is -7 dBm. If you use optical loopback for diagnostics purposes, the loopback requires a minimum of 15 dB optical attenuation. The recommended attenuation range is 15 dB to 20dB.

LW XENPAK

The LW XENPAK module requires the software versions listed in Table 9.

Table 9: LW XENPAK Software Requirements

Switch Model	Required Software Release
BlackDiamond Switches	
BlackDiamond 10808	ExtremeXOS 11.4.1 or later
BlackDiamond 12804	ExtremeXOS 11.4.1 or later
BlackDiamond 12802	ExtremeXOS 12.0 or later
Summit Switches	
Summit X450a	ExtremeXOS 11.5.0 or later
Summit X450e	ExtremeXOS 11.5.0 or later

NOTE

BlackDiamond 10808 switches and BlackDiamond 12804 switches running software earlier than ExtremeXOS 11.4.2.3 do not support jumbo-size frame for the LW XENPAK. These switches support only standard-size frame for the LW XENPAK.

BlackDiamond 10808 switches and BlackDiamond 12804 switches running the latest version of ExtremeXOS 11.4 support jumbo-size frame for the LW XENPAK with a 5% decrease in performance, allowing for 95% of the maximum WAN PHY traffic.

ExtremeXOS 11.5.0 or later supports the LW XENPAK at full functionality with 100% performance in the Summit X450a and X450e series switches.

CAUTION

The maximum input power (average receive power) should be less than 0.5 dBm.

For technical specifications for the LW XENPAK, see Appendix B.

Transmitter Clock Locking Mode

The LW XENPAK module provides an interface connection between a 10-gigabit Ethernet and a 10-gigabit SONET/SDH network from a 10-gigabit Ethernet equipment port.

The default transmitter clock locking mode of the LW XENPAK module is set to line timing mode. When in line timing mode, the LW XENPAK module transmitter clock is locked to the receiver-recovered clock. When the LW XENPAK is connected to the SONET/SDH network on the other side of optical cable, the LW XENPAK transmitter clock synchronizes with the SONET/SDH clock source, which helps reduce the pointer adjustment between the SONET/SDH network and the LW XENPAK.

To prevent a clock reference loop, be sure that only one end of a link is using line timing mode and to use internal timing when testing with an optical loopback cable.

LX4 XENPAK

The LX4 XENPAK supports multimode MMF cable in intra-building connections and SMF cable for interbuilding connections. The LX4 XENPAK has SC connectors.

The LX4 XENPAK requires the software versions listed in Table 10.

Table 10: LX4 XENPAK Software Requirements

Switch Model	Required Software
BlackDiamond Switches	
BlackDiamond 10808	ExtremeXOS 11.3.1 or later
BlackDiamond 8800 series	ExtremeXOS 11.3.1 or later
BlackDiamond 12804	ExtremeXOS 11.4 or later
BlackDiamond 12802	ExtremeXOS 12.0 or later
Summit Switches	
Summit X450 series	ExtremeXOS 11.3.1 or later
Summit X450a series	ExtremeXOS 11.3.1 or later
Summit X450e series	ExtremeXOS 11.3.1 or later

For technical specifications for the LX4 XENPAK, see Appendix B.

Installing and Removing a XENPAK Module

WARNING!

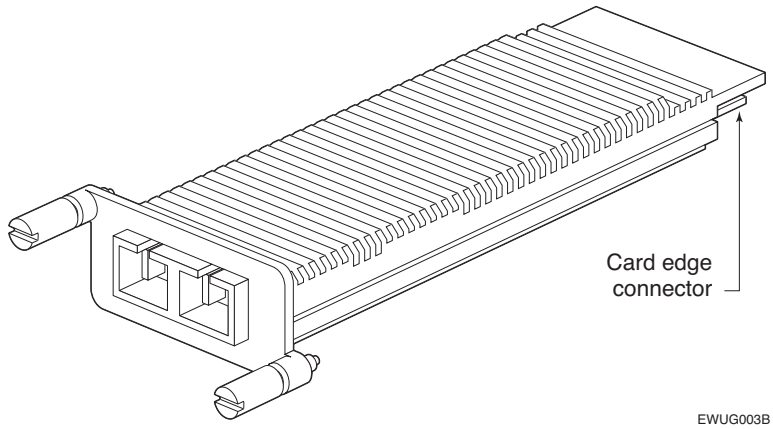
XENPAK modules become very hot after prolonged use. Be careful when removing a XENPAK module from the chassis or option card. If the XENPAK module is too hot to touch, disengage the XENPAK module and allow it to cool before removing it completely.

This section describes installing and removing the XENPAK module (Figure 20). You can install or remove the XENPAK module from your Extreme Networks switch without powering off the system.

NOTE

On a Summit X450 series, X450a series, or X450e series switch, the XENPAK module is inserted into an optional module card. Although the module card is not hot-swappable, you can hot swap the XENPAK into and out of the module card on the Summit. For information about the optional module card for XENPAKs on a Summit X450 series, X450a series, or X450e series switch, see the Summit Family Switches Hardware Installation Guide.

Figure 20: XENPAK Module



WARNING!

XENPAK modules contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam. This device is compliant with FCC 21 CFR 1040.10, and EN60825-1 A2:2001.

CAUTION

To prevent ESD damage to the XENPAK module, always use an appropriately grounded ESD-preventive wrist strap when installing or removing the module. Handle the module by its sides only. Never touch the card-edge connectors at the insertion end of the module.

Installing a XENPAK Module

To install a XENPAK module:

1. Remove the XENPAK module from its antistatic container and remove the dust covers from the module optical connectors.

   If your module has a protective pad covering the card-edge connector, remove it. Store the antistatic container, dust covers, and card-edge connector protective pad in a clean location from which they can be easily retrieved if you need to uninstall the module.
2. Remove any dust covers from the port on the module into which you are installing the XENPAK module.
3. Holding the module by its sides, insert the XENPAK module into the slot on the I/O module or Summit option card.
4. Slide the XENPAK module as far back into the slot as possible, until you hear it click, indicating that it is firmly attached.
5. Secure the XENPAK module to the I/O module or option card by turning the two captive screws clockwise until the screws are hand-tight.

NOTE

To ensure that your XENPAK module is undamaged upon installation, you can correlate factory test data with your installation site test data by consulting the average power reference values shown on the XENPAK module test data sheet (Part No. 121074-00) enclosed with your module.

Removing a XENPAK Module

To remove a XENPAK module:

1 Disconnect the optical cable from the XENPAK module.

WARNING!

XENPAK modules contain Class 1 lasers. Invisible laser radiation can occur when laser connections are unplugged. Do not stare into the beam.

2 Loosen the two captive screws until they are completely free from the I/O module faceplate or the Summit option card. (The captive screws remain attached to the XENPAK module.)

3 Gripping both captive screws, carefully pull the XENPAK module out of the slot.

4 Place the dust covers back into the XENPAK module connectors.

5 Place the XENPAK module immediately into an antistatic container to protect it from ESD damage and dust.

A Safety Information

APPENDIX

WARNING!

Read the following safety information thoroughly before installing Extreme Networks products. Failure to follow this safety information can lead to personal injury or damage to the equipment.

Only trained service personnel should perform service to Extreme Networks switches and their components. Trained service personnel have read all related installation manuals, have the technical training and experience necessary to be aware of the hazards to which they are exposed in performing a task, and are aware of measures to minimize the danger to themselves or other persons.

Fiber Optic Ports—Optical Safety

The following safety warnings apply to all optical devices used in Extreme Networks equipment that are removable or directly installed in an I/O module or chassis system. These devices include, but are not limited to, the following devices:

- SC gigabit interface converters (GBICs)
- SFP optical modules (mini-GBICs) and SFP+ optical modules
- QSFP+ optical modules
- XENPAK transceivers
- XFP laser optic modules

CAUTION

Laser optic modules become very hot after prolonged use. Take care when removing a laser optic module from the chassis or option card. If the laser optic module is too hot to touch, disengage the laser optic module and allow it to cool before removing it completely.

WARNING!

When working with laser optic modules, always take the precautions listed below to prevent exposure to hazardous radiation:

- Never look at the transmit LED/laser through a magnifying device while it is powered on.
- Never look directly at a fiber port on the switch or at the ends of a fiber cable when they are powered on.
- Invisible laser radiation can occur when the connectors are open. Avoid direct eye exposure to the beam when optical connections are unplugged.
- Never alter, modify, or change an optical device in any way other than suggested in this document.

GBIC, SFP (Mini-GBIC), SFP+, QSFP+, XENPAK, and XFP Regulatory Compliance

- Class 1 or Class 1M Laser Product
- EN60825-1+A2:2001 or later, European laser standard
- FCC 21 CFR Chapter 1, Subchapter J in accordance with FDA & CDRH requirements
- Application of CE Mark in accordance with the 2004/108/EC EMC Directive, and the 2006/95/EC Low Voltage Directive
- UL and/or CSA registered component for North America
- 47 CFR Part 15, Class A when installed into Extreme products

Using Third-Party Optical Modules

Extreme Networks optical modules are tested to work in all supported Extreme Networks switches. We recommend that all customers use Extreme Networks optical modules in their Extreme Networks switches. Extreme Networks assumes no liability for third-party optical modules. Although Extreme Networks does not block third-party optical modules, we cannot ensure that all third-party optical modules operate properly in all Extreme Networks switches. The customer assumes all risks associated with using third-party optical modules in Extreme Networks switches.

Sicherheitshinweise

WARNING!

Vor der Installation der Produkte von Extreme Networks sind die nachfolgenden Sicherheitshinweise aufmerksam zu lesen. Die Nichtbeachtung dieser Sicherheitshinweise kann zu Verletzungen oder Schäden an der Ausrüstung führen.

Installation, Wartung und Ausbau eines Switch, einer Grundplatte oder einer seiner Komponenten dürfen nur von geschultem und qualifiziertem Servicepersonal durchgeführt werden! Geschulte und qualifizierte Servicetechniker verfügen über die erforderliche technische Ausbildung und Erfahrung, um mögliche Gefahren bei der Durchführung von Servicearbeiten zu erkennen und Maßnahmen zur Minimierung der Gefahr für sich bzw. andere zu treffen.

Lichtleiteranschlüsse: Optische Sicherheit

WARNING!

Beim Umgang mit Lichtleitermodulen sind folgende Vorsichtsmaßnahmen zu beachten:

- Niemals durch ein Vergrößerungsgerät auf die übertragende LED/den Laser schauen, wenn diese(r) eingeschaltet ist.
- Niemals direkt auf einen Lichtleiteranschluss am Switch oder auf die Enden eines Faserkabels schauen, wenn diese eingeschaltet sind.
- Bei offenen Anschlüssen kann es zu unsichtbarer Laserstrahlung kommen. Direkter Augenkontakt mit dem Strahl ist zu vermeiden.
- Ein optisches Gerät niemals auf andere Weise verändern oder modifizieren als in diesem Dokument angegeben.

Einhaltung behördlicher Vorschriften durch GBIC, Mini-GBIC, QSFP+, XENPAK und XFP

- Laserprodukt der Klasse 1 oder 1M
- EN60825-1+A2:2001 oder jünger, Europäische Richtlinie für Lasersysteme
- Anwendung der CE-Kennzeichnung gemäß der Richtlinien 89/336/EWG EMV und 73/23/EWG für Niederspannungsgeräte

B Technical Specifications

APPENDIX

This appendix includes the following technical specifications:

- SFP Specifications on page 53
- SFP+ Specifications on page 59
- QSFP+ Specifications on page 61
- XFP Specifications on page 62
- XENPAK Specifications on page 66
- Pluggable Interface Module Regulatory Compliance on page 69

SFP Specifications

The SX SFP conforms to the 1000BASE-SX standard. Table 11 lists the specifications for the SX SFP interface.

Table 11: SX SFP Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-9.5 dBm		-4 dBm
Center wavelength	830 nm	850 nm	860 nm
Receiver			
Receive sensitivity			-17 dBm
Average receive power (max)			0 dBm
Operating wavelength	770 nm	850 nm	860 nm
Link			
Link power budget			7.5 dB
Operating distance			550 m

The LX SFP conforms to the 1000BASE-LX standard. Table 12 lists the specifications for the LX SFP interface.

Table 12: LX SFP Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-9.5 dBm		-3 dBm
Center wavelength	1270 nm	1310 nm	1355 nm
Receiver			
Receive sensitivity			-19 dBm
Average receive power (max)			-3 dBm
Operating wavelength	1270 nm	1310 nm	1355 nm
Link			
Link power budget			8 dB
Operating distance			10 km

Table 13 lists the specifications for the ZX SFP interface.

Table 13: ZX SFP Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-2 dBm	0 dBm	3 dBm
Center wavelength	1530 nm	1550 nm	1570 nm
Receiver			
Receive sensitivity			-24 dBm
Average receive power (max)			-3 dBm
Operating wavelength	1530 nm	1550 nm	1570 nm
Operating distance			80 km

Table 14 lists specifications for the 1000BASE-BX bi-directional SFPs. The 1000BASE-BX SFP modules conform to the IEEE 802.3ah 1000BASE-BX10 standard.

Table 14: 1000BASE-BX Bi-directional SFP Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-9 dBm		-3 dBm
Center wavelength (1000BASE-BX10-D)	1480 nm	1490 nm	1550 nm
Center wavelength (1OOOBASE-BX10-U)	1260 nm	1310 nm	1360 nm
Receiver			
Receive sensitivity			-19 dBm
Average receive power (max)			-3 dBm
Link			
Link power budget			8 dB
Operating distance			10 km

NOTE

The 1000BX bidirectional SFPs include two SFP optical devices, the 1000BASE-BX-U SFP and the 1000BASE-BX-D SFP, which must be used as a pair to allow for a single fiber bidirectional connection.

Table 15 lists the specifications for the 100FX SFP module for Gigabit Ethernet (GE) ports. The 100FX SFP for GE ports conforms to the 100FX-MMF standard.

Table 15: 100FX SFP (GE Ports) Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-20 dBm		-14 dBm
Center wavelength	1270 nm	1310 nm	1380 nm
Receiver			
Receive sensitivity			-31 dBm
Average receive power (max)			-14 dBm
Operating distance range over each fiber type:			
62.5/125 μm MMF	2 m		2000 m
50/125 μm MMF	2 m		2000 m

Table 16 lists the specifications for the dual-speed 100FX/1000LX SFP module for Gigabit Ethernet (GE) ports. Operating at 100 Mbps, the dual-speed SFP conforms to the 100BASE-LX10 standard. Operating at 1000 Mbps, the dual-speed SFP conforms to the 1000BASE-LX standard.

Table 16: Dual-speed 100FX/1000LX SFP Specifications

Parameter	100FX	1000LX
Connector type	LC	LC
Average launch power range with 9 um SMF	-8 dBm to -15 dBm	-3 dBm to -11 dBm
Receiver power range with 9 um SMF	-8 dBm to -25 dBm	-3 dBm to -19 dBm
Optical link budget with 9 um SMF	10 dB	8 dB
Center wavelength range	1270 to 1355	1270 to 1355
Operating distance range over each optical fiber type (see note below table):		
62.5/125 µm MMF	2 to 2000 m	2 to 550 m
50/125 µm MMF	2 to 2000 m	2 to 550 m
9/125 µm SMF	2 to 10,000 m	2 to 10,000 m

NOTE

The 100FX/1000LX SFP module complies with the 100FX-SMF standard. To use the 100FX/1000LX SFP module in 100FX-MMF operation, a minimum attenuation of 6 dB is required. After the SFP module is installed, connect a 6-dB attenuator to the transmitter side (Tx) of the SFP module. Next, connect the attenuator to the single-mode end of a mode conditioning patch cord. The mode conditioning patch cord transitions the SFP module from SMF to MMF operation.

Table 18 lists specifications for the LX100 SFP module.

Table 17: LX100 SFP specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	1 dBm	3 dBm	5 dBm
Center wavelength	1480 nm	1550 nm	1580 nm
Receiver			
Receive sensitivity			–30 dBm
Average receive power			–9 dBm
Operating wavelength	1260 nm	1550 nm	1580 nm
Operating distance			100 km

Table 18 lists specifications for the 100BASE-LX10 SFP module.

Table 18: 100BASE-LX10 SFP Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	–15 dBm	–10 dBm	–8 dBm
Center wavelength	1260 nm	1310 nm	1360 nm
Receiver			
Receive sensitivity			–25 dBm
Average receive power			–8 dBm
Operating wavelength	1260 nm	1310 nm	1360 nm
Link			
Link Power Budget			10 dB
Operating distance			10 km

Table 19 lists specifications for the 100BX Bi-directional SFPs. The 100BASE-BX SFP modules conform to the IEEE 802.3ae standard.

Table 19: 100BASE-BX Bi-directional SFP Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	–14 dBm	–8 dBm
Center wavelength (100BASE-BX10-D)	1480 nm	1580 nm
Center wavelength (1OOBASE-BX10-U)	1260 nm	1360 nm
Receiver		
Receive sensitivity	–28.2 dBm	
Average receive power (max)		–8 dBm
Link		
Link power budget		14.2 dB
Operating distance		10 km

NOTE

The 100BX bidirectional SFPs include two SFP optical devices, the 100BASE-BX-U SFP and the 100BASE-BX-D SFP, which must be used as a pair to allow for a single fiber bidirectional connection.

Table 15 lists the specifications for the 100BASE-FX SFP module for fast Ethernet (FE) ports.

Table 20: 100BASE-FX SFP for FE Ports Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	-20 dBm	-14 dBm
Center wavelength	1270 nm	1380 nm
Receiver		
Receive sensitivity	-31 dBm	
Average receive power (max)		-14 dBm
Operating distance range over each fiber type:		
62.5/125 μm MMF	2 m	2000 m
50/125 μm MMF	2 m	2000 m

Table 21 lists specifications for the 10/100/1000BASE-T copper SFP module. The 10/100/1000BASE-T copper SFP module is compatible with the Gigabit Ethernet standard and 1000 Base-T standard as specified in the IEEE 802.3ab standard.

Table 21: 10/100/1000BASE-T Copper SFP Specifications

Parameter	Value
Input voltage range	3.3 V ± 5%
Supply current	375 mA maximum
Link distance for each speed	
1 Gbps	100 m using Cat5 cable
100 Mbps	150 m using Cat5 cable
10 Mbps	250 m using Cat5 cable

SFP+ Specifications

Table 22 lists the specifications for the SR SFP+ module. The SR SFP+ module conforms to the 10GBASE-SR standard.

Table 22: SR SFP+ Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-7.3 dBm		-1 dBm
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Receive sensitivity			-11 dBm
Average receive power (max)			-1 dBm
Operating wavelength	840 nm	850 nm	860 nm
Link			
Link power budget			7.5 dB
Operating distance range (depends on type and modal bandwidth):			
62.5 µm MMF (160 MHz*km) 62.5 µm MMF (200 MHz*km) 50 µm MMF (400 MHz*km) 50 µm MMF (500 MHz*km) 50 µm MMF (2000 MHz*km)			26 m 33 m 66 m 82 m 300 m

Table 23 lists the specifications for the LR SFP+ module. The LR SFP+ module conforms to the 10GBASE-LR standard.

Table 23: LR SFP+ Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-8.2 dBm		0.5 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Receiver			
Average receive power (max)	–14.4 dBm		–1 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Maximum receiver sensitivity in OMA			–12.6 dBm
Operating distance			10 km

Table 24 lists the specifications for the ER SFP+ module. The ER SFP+ module conforms to the 10GBASE-ER standard.

Table 24: ER SFP+ Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power			4 dBm
Center wavelength	1530 nm	1550 nm	1565 nm
Receiver			
Average receive power (max)	–15.8 dBm		–1 dBm
Center wavelength	1530 nm	1550 nm	1565 nm
Maximum receiver sensitivity in OMA			–14.1 dBm[1]
Operating distance			40 km

1.OMA=$10\log_{10}[2P\{(A-1)/(A+1)\}]$, $A = 10^{(Er/10)}$, $P = 10^{(Pf/10)}$

Table 25 lists specifications for the LRM SFP+ module. The LRM SFP+ module conforms to the 10GBASE-LRM standard

Table 25: LRM SFP+ Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power	–6.5 dBm	0.5 dBm
Center wavelength	1260 nm	1355 nm
Receiver		
Average receive power (max)	–6.5 dBm	0.5 dBm
Center wavelength	1260 nm	1355 nm
Maximum receiver sensitivity in OMA		1.5 dBm
Operating distance		220 m

QSFP+ Specifications

Table 26 lists the specifications for the SR4 QSFP+ module. The SR4 QSFP+ module conforms to the 802.3ba D3.2 (40GBASE-SR4) standard. This module is a Class 1M laser device.

Table 26: SR4 QSFP+ Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power, each lane	-7.6 dBm		2.4 dBm
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Stressed receiver sensitivity in OMA, each lane			-5.4 dBm
Average receive power (max), each lane	-9.5 dBm		2.4 dBm
Operating wavelength	840 nm	850 nm	860 nm
Link			
Link power budget	1.9 dB		10 dB
Operating distance over each fiber type:			
OM3 fiber OM4 fiber			100 m 150 m

XFP Specifications

Table 27 lists the specifications for the LR XFP module.

Table 27: LR XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-8.2 dBm		0.5 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Receiver			
Average receiver power (max)			0.5 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Stressed receiver sensitivity in OMA			-10.3 dBm 0.093 mW[1]
Operating distance			10 km

1.OMA=$10\log_{10}[2P\{(A-1)/(A+1)\}]$, $A = 10^{(Er/10)}$, $P = 10^{(Pf/10)}$

Table 28 lists specifications for the ER XFP module.

Table 28: ER XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	–4.7 dBm		4 dBm
Center wavelength	1530 nm		1565 nm
Receiver			
Average receiver power (max)	–11.8 dBm		–1 dBm
Center wavelength	1260 nm		1580 nm
Maximum receiver sensitivity in OMA			14.1 dBm[1]
Operating distance			40 km

1.OMA=$10\log_{10}[2P\{(A-1)/(A+1)\}]$, $A = 10^{(Er/10)}$, $P = 10^{(Pf/10)}$

Table 29 lists specifications for the SR XFP module.

Table 29: SR XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-7.3 dBm		–1.3 dBm
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Average receiver power (max)	–9.9 dBm		–1 dBm
Center wavelength	840 nm		860 nm
Maximum receiver sensitivity in OMA			-11.1 dBm[1]
Operating distance			300 m
Operating distance range (depends on type and modal bandwidth)			
62.5 μm MMF (160 MHz*km) 62.5 μm MMF (200 MHz*km) 50 μm MMF (400 MHz*km) 50 μm MMF (500 MHz*km) 50 μm MMF (2000 MHz*km)			26 m 33 m 66 m 82 m 300 m

1.OMA=$10\log_{10}[2P\{(A-1)/(A+1)\}]$, $A = 10^{(Er/10)}$, $P = 10^{(Pf/10)}$

Table 30 lists specifications for the ZR XFP module.

Table 30: ZR XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	0.5 dBm	2 dBm	4 dBm
Center wavelength	1530 nm	1550 nm	1565 nm
Receiver			
Average receiver power (max)			–7 dBm
Center wavelength		1550 nm	
Receiver sensitivity	–24 dBm		
Operating distance			80 km

Table 31 lists specifications for the tunable DWDM XFP module. Table 32 lists the transmitter center wavelength associated with each configurable channel on the tunable DWDM module.

Table 31: Tunable DWDM XFP Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	–1 dBm		3 dBm
Center wavelength		See Table 32	
Receiver			
Average receiver power (max)			–7 dBm
Center wavelength	1260 nm		1600 nm
Receiver sensitivity	–24 dBm		
Operating distance			80 km

Table 32: TX Wavelengths and Channel Assignments for the Tunable DWDM XFP

TX Wavelength	Channel	TX Wavelength	Channel	TX Wavelength	Channel	TX Wavelength	Channel
1568.77 nm	11	1558.17 nm	24	1547.72 nm	37	1537.40 nm	50
1568.36 nm	1150	1557.77 nm	2450	1547.32 nm	3750	1537.00 nm	5050
1567.95 nm	12	1557.36 nm	25	1546.92 nm	38	1536.61 nm	51
1567.54 nm	1250	1556.96 nm	2550	1546.52 nm	3850	1536.22 nm	5150
1567.13 nm	13	1556.55 nm	26	1546.12 nm	39	1535.82 nm	52
1566.72 nm	1350	1556.15 nm	2650	1545.72 nm	3950	1535.43 nm	5250
1566.31 nm	14	1555.75 nm	27	1545.32 nm	40	1535.04 nm	53
1565.90 nm	1450	1555.34 nm	2750	1544.92 nm	4050	1534.64 nm	5350
1565.50 nm	15	1554.94 nm	28	1544.53 nm	41	1534.25 nm	54
1565.09 nm	1550	1554.54 nm	2850	1544.13 nm	4150	1533.86 nm	5450
1564.68 nm	16	1554.13 nm	29	1543.73 nm	42	1533.47 nm	55
1564.27 nm	1650	1553.73 nm	2950	1543.33 nm	4250	1533.07 nm	5550
1563.86 nm	17	1553.33 nm	30	1542.94 nm	43	1532.68 nm	56
1563.45 nm	1750	1552.93 nm	3050	1542.54 nm	4350	1532.29 nm	5650
1563.05 nm	18	1552.52 nm	31	1542.14 nm	44	1531.90 nm	57
1562.64 nm	1850	1552.12 nm	3150	1541.75 nm	4450	1531.51 nm	5750
1562.23 nm	19	1551.72 nm	32	1541.35 nm	45	1531.12 nm	58
1561.83 nm	1950	1551.32 nm	3250	1540.95 nm	4550	1530.72 nm	5850
1561.42 nm	20	1550.92 nm	33	1540.56 nm	46	1530.33 nm	59
1561.01 nm	2050	1550.52 nm	3350	1540.16 nm	4650	1529.94 nm	5950
1560.61 nm	21	1550.12 nm	34	1539.77 nm	47	1529.55 nm	60
1560.20 nm	2150	1549.72 nm	3450	1539.37 nm	4750	1529.16 nm	6050
1559.79 nm	22	1549.32 nm	35	1538.98 nm	48	1528.77 nm	61
1559.39 nm	2250	1548.91 nm	3550	1538.58 nm	4850	1528.38 nm	6150
1558.98 nm	23	1548.51 nm	36	1538.19 nm	49		
1558.58 nm	2350	1548.11 nm	3650	1537.79 nm	4950		

XENPAK Specifications

Table 33 lists specifications for the SR XENPAK module

Table 33: SR XENPAK Module Specifications

Parameter	Minimum	Typical	Maximum
Transmitter			
Average launch power	-7.3 dBm		–1.3 dBm
Center wavelength	840 nm	850 nm	860 nm
Receiver			
Average receiver power (max)	–9.9 dBm		–1 dBm
Center wavelength	840 nm		860 nm
Maximum receiver sensitivity in OMA			-11.1 dBm[1]
Operating distance			300 m
Operating distance range (depends on type and modal bandwidth)			
62.5 µm MMF (160 MHz*km) 62.5 µm MMF (200 MHz*km) 50 µm MMF (400 MHz*km) 50 µm MMF (500 MHz*km) 50 µm MMF (2000 MHz*km)			26 m 33 m 66 m 82 m 300 m

1.OMA=$10\log_{10}[2P\{(A-1)/(A+1)\}]$, $A = 10^{(Er/10)}$, $P = 10^{(Pf/10)}$

NOTE

The launch power (measured using the average power method used by power meters) is measured at the factory. The average launch power minimum value is provided as a reference, not a pass/fail criterion.

Table 34 lists specifications for the LR XENPAK module.

Table 34: LR XENPAK Module Specifications

Parameter	Minimum		Maximum
Transmitter			
Average launch power	-8.2 dBm		0.5 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Receiver			
Average receiver power (max)			0.5 dBm
Center wavelength	1260 nm	1310 nm	1355 nm
Stressed receiver sensitivity in OMA			-10.3 dBm 0.093 mW[1]
Operating distance			10 km

1.OMA=$10\log_{10}[2P\{(A-1)/(A+1)\}]$, $A = 10^{(Er/10)}$, $P = 10^{(Pf/10)}$

Table 35 lists specifications for the ER XENPAK module.

Table 35: ER XENPAK Module Specifications

Parameter	Minimum	Maximum
Average launch power	-4.7 dBm	4.0 dBm
Optical link budget		10.9 dB
Wavelength range	1530 nm	1565 nm
Distance range: 5 dBm attentuation	2 m	40 km
Maximum receiver sensitivity in OMA		-14.1 dBm

NOTE

The launch power (measured using the average power method used by power meters) is measured at the factory. The average launch power minimum value is provided as a reference, not a pass/fail criterion.

Table 36 lists specifications for the ZR XENPAK module.

Table 36: ZR XENPAK Module Specifications

Parameter	Minimum	Maximum
Transmitter		
Optical output power	0 dBm	4 dBm
Center wavelength	1530 nm	1565 nm
Receiver		
Optical input power	-22 dBm	-7 dBm
Operating wavelength	1530 nm	1565 nm
General		
Optical link loss	11 dB	22 dB
Optical dispersion	0 ps/nm	1600 ps/nm
Operating distance		80 km

WARNING!

To prevent permanent damage to the ZR XENPAK and other equipment: always check the optical input power of the receiver before inserting the fiber. The maximum optical input power for the receiver is -7 dBm. If you use optical loopback for diagnostics purposes, the loopback requires a minimum of 10 dB optical attenuation. The recommended attenuation range is 10 dB to 15 dB.

Table 37 lists specifications for the LX4 XENPAK module.

Table 37: LX4 XENPAK Module Specifications

Parameter	Minimum	Maximum
Transmitter		
Average launch power, 4 lanes		+ 5.5 dBm
Average launch power, per lane		- 0.5 dBm
Optical modulation amplitude (OMA), per lane:		
SMF	- 6.25 dBm	- 1.25 dBm
MMF	- 6.75 dBm	- 1.25 dBm
Receiver		
Average receive power, 4 lanes		+ 5.5 dBm
Average receive power, per lane		- 0.5 dBm
Receive sensitivity (OMA), per lane		- 14.45 dBm
Optical link budget		
Wavelength range	1269.0 nm 1293.5 nm 1318.0 nm 1342.5 nm	1282.4 nm 1306.9 nm 1331.4 nm 1355.9 nm
Operating distance range:		
SMF		10 km
MMF		300 m

Table 38 lists specifications for the LW XENPAK module.

Table 38: LW XENPAK Module Specifications

Parameter	Measurement
Transmitter	
Signaling speed (nominal)	9.95328 GBd
Signaling speed variation from nominal (max)	+/-20 ppm
Center wavelength (range)	1260 to 1355 nm
Average launch power (max)	0.5 dBm
Average launch power (min)	-8.2 dBm
Receiver	
Center wavelength (range)	1260 to 1600 nm
Average receive power (max)	0.5 dBm
Average receive power (min)	-14.4 dBm
Receive sensitivity (max) in OMA	0.055 (-12.6) uW/dBm
Operating distance	10 Km

CAUTION

The maximum input power (average receive power) should be less than 0.5 dBm)

Pluggable Interface Module Regulatory Compliance

Extreme Networks pluggable interface modules comply with the following agency requirements:

- Class 1 Laser Product (optical modules only)
- EN60825-1+A2:2001 or later, European laser standard (optical modules only)
- FCC 21 CFR Chapter 1, Subchapter J in accordance with FDA & CDRH requirements (optical modules only)
- Application of CE Mark in accordance with 89/336/EEC EMC and 73/23/EEC Low Voltage Directives
- UL and/or CSA registered component for North America
- 47 CFR Part 15, Class A when installed into Extreme products

SFP+ and QSFP+ Direct-Attach Cable Regulatory Compliance

- Application of CE Mark in accordance with 2004/108/EC EMC and 93/68/EEC Low Voltage Directives
- UL registered component for North America
- 47 CFR Part 15, Class A when installed into Extreme products

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